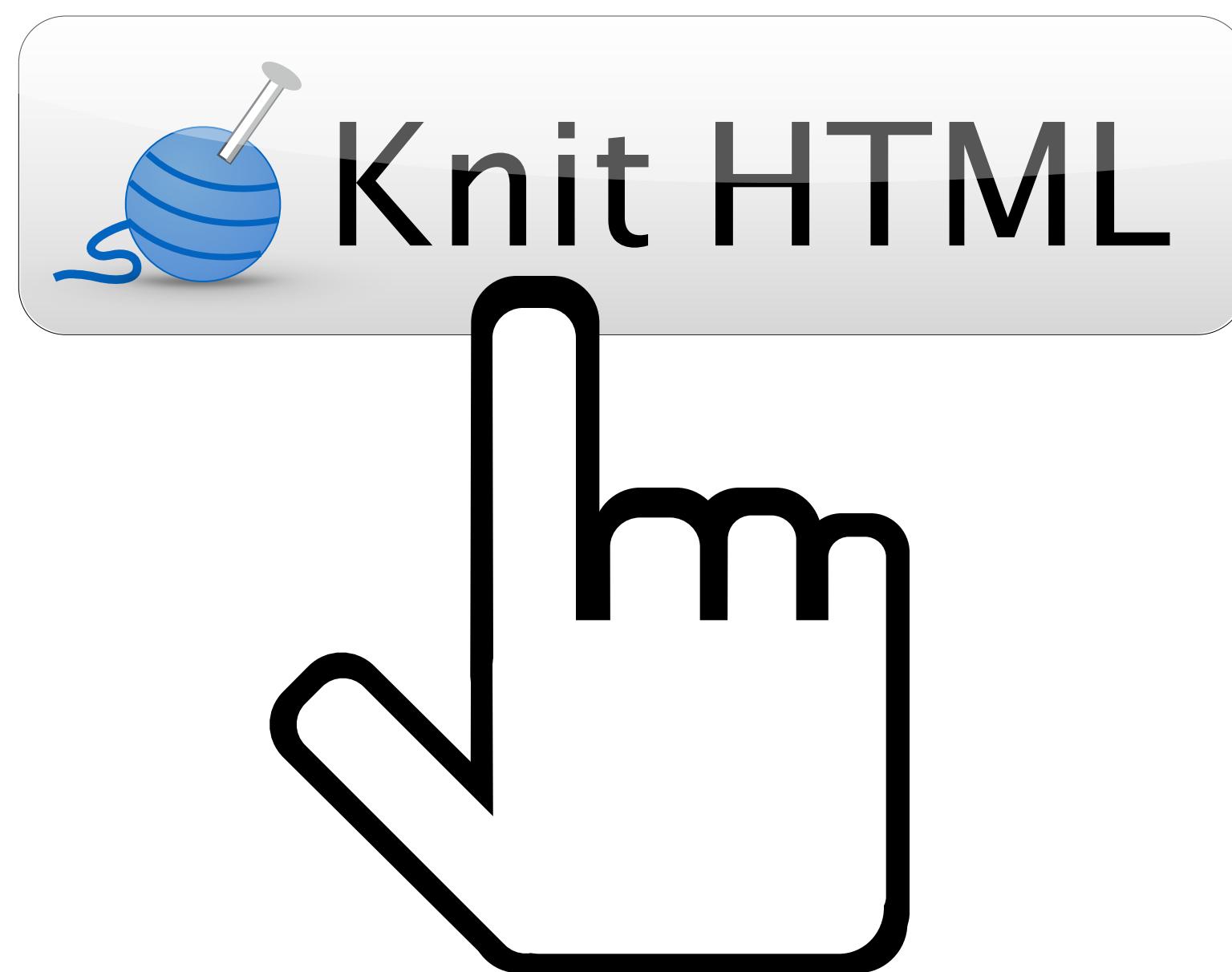


# Reproducible Reports with R Markdown

One format to rule them all



Garrett Grolemund

Data Scientist and Master Instructor  
Rstudio, Inc.  
October 2015  
 @StatGarrett



@StatGarrett



O'REILLY®



# Hands-On Programming with R

WRITE YOUR OWN FUNCTIONS AND SIMULATIONS

Garrett Grolemund  
Foreword by Hadley Wickham

O'REILLY®



# Introduction to Data Science with R

*Garrett Grolemund*

VIDEO



DataCamp



Reporting with  
R Markdown



Data Visualization  
in R with ggvis



Data Manipulation  
in R with dplyr

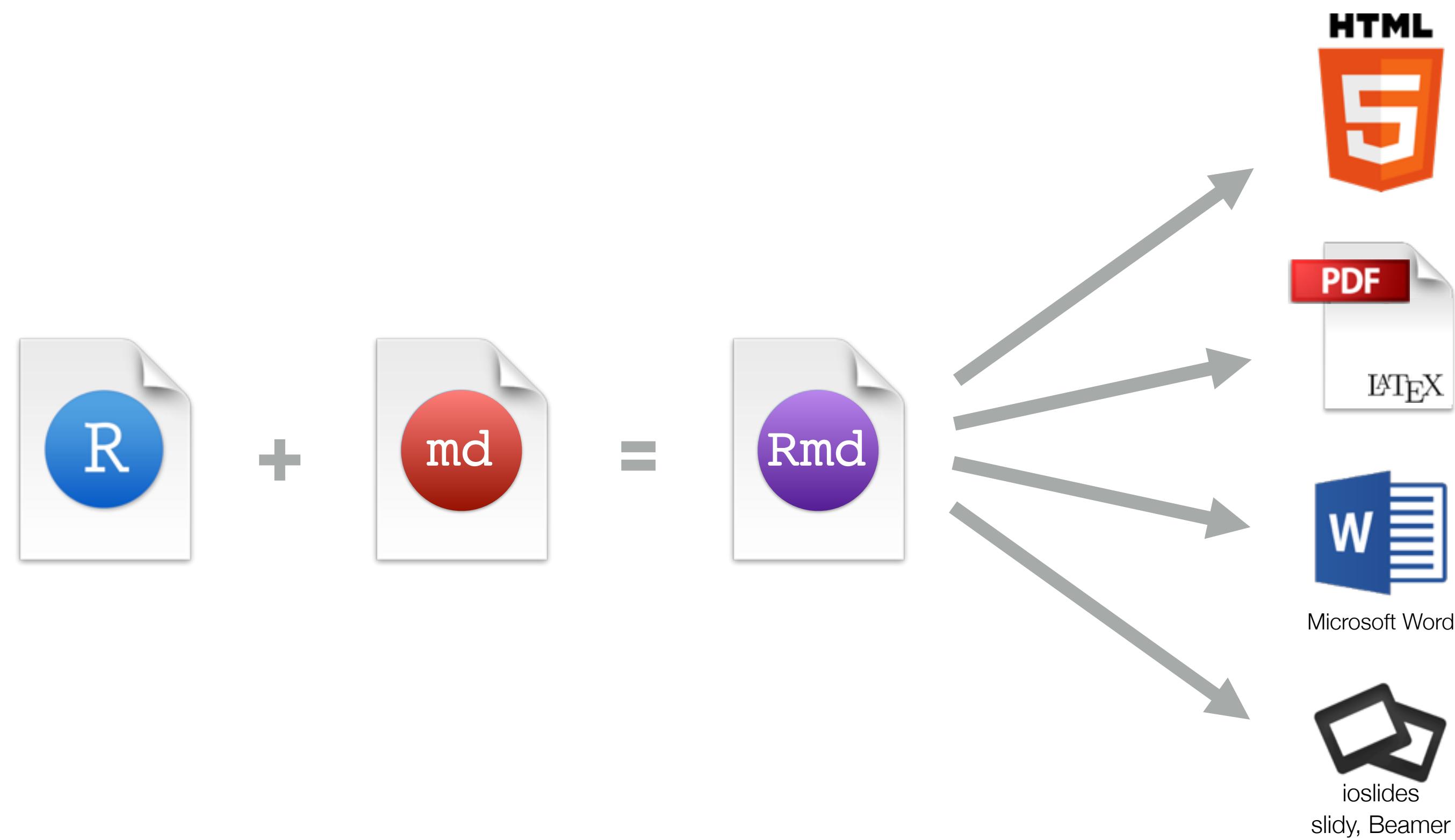
**Reproducible  
reports**

# How can you reproduce results?

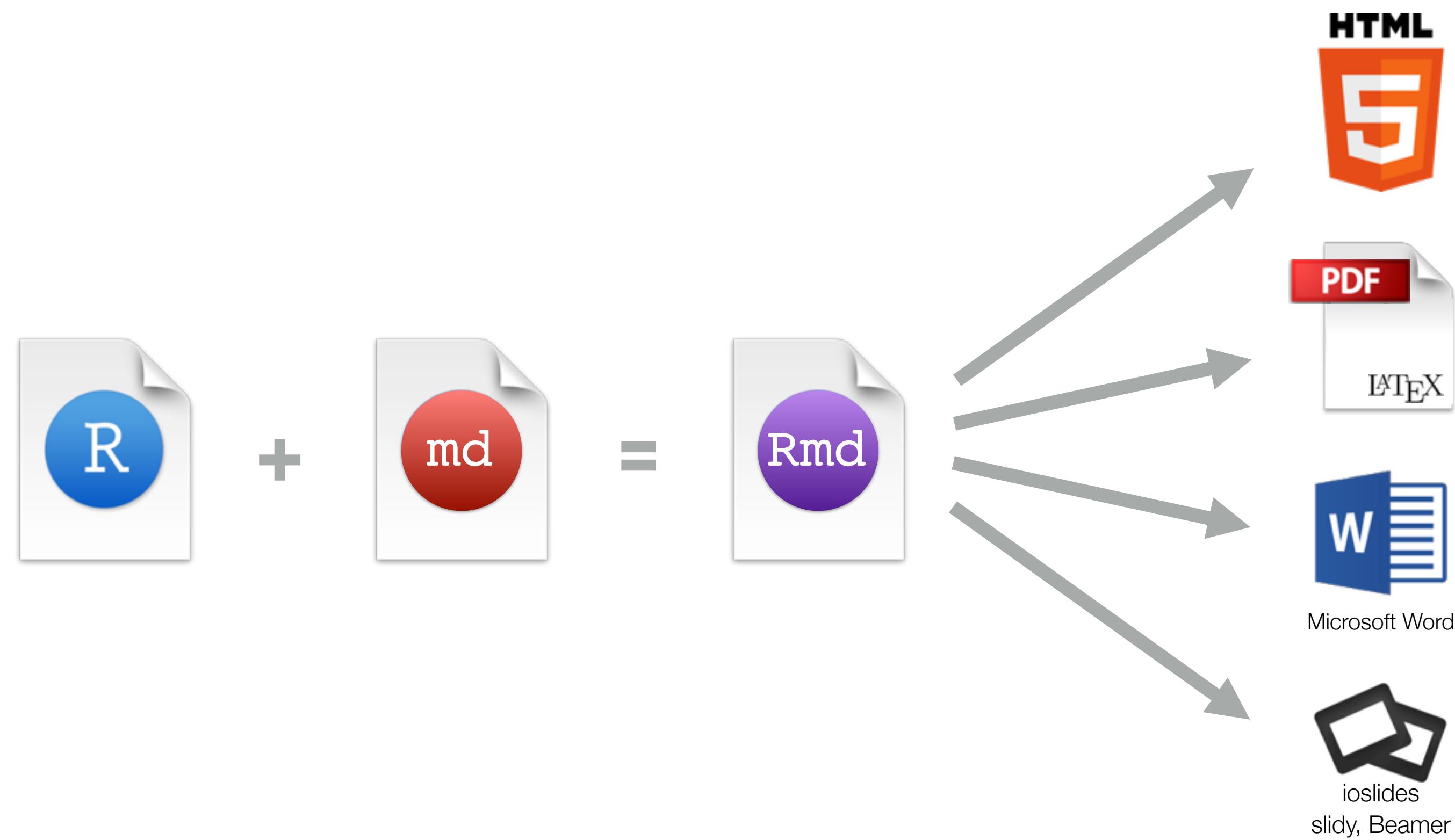
**Ctrl** + **C**      (Copy)

**Ctrl** + **V**      (Paste)

# R Markdown



# R Markdown



# demo

1. Open a new  
`.Rmd` file

2. Edit text

3. Click "Knit HTML"

4. Preview output

5. Access output file

6. Publish

7. Re-run analysis in console

The screenshot shows the RStudio interface with the following steps highlighted:

- 1. Open a new `.Rmd` file:** The left pane shows the file browser with an `outline.Rmd` file selected.
- 2. Edit text:** The main editor pane contains a bio text for Garrett Grolemund.
- 3. Click "Knit HTML":** A context menu is open over the text, with "Knit HTML" as the active option.
- 4. Preview output:** The right pane shows a preview of the generated HTML resume.
- 5. Access output file:** The bottom-right pane shows the file browser again, with the generated `resume.html` file listed.
- 6. Publish:** A "Publish" button is visible in the top right of the preview pane.
- 7. Re-run analysis in console:** A large black arrow points from this text down to the RStudio console at the bottom of the interface.

**Garrett Grolemund**

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rstudio.com  
Orlando, FL

## Expertise

I wrote the popular [lubridate](http://www.r-statistics.com/2012/03/do-more-with-dates-and-times-in-r-with-lubridate-1-1-0/) package and am the author of *Hands On Programming with R* as well as *Data Science with R*, an upcoming book from O'Reilly Media. I have a Ph.D. in Statistics and specialize in the theory of data science. I enjoy:

- **Teaching** - I design and teach workshops for RStudio. I'm also the Editor-in-Chief of the [Shiny Development Center](http://shiny.rstudio.com), a great place to learn Shiny.
- **Statistics** - I have an M.A. in Statistics from Harvard University and a Ph.D. in Statistics

**Environment History Files**

Name	Size	Modified
..		
outline.Rmd	1.7 KB	Feb 3, 2015, 6:32 PM
resume.html	631.2 KB	Feb 3, 2015, 7:08 PM
resume.Rmd	929 B	Feb 3, 2015, 7:08 PM

# Markdown

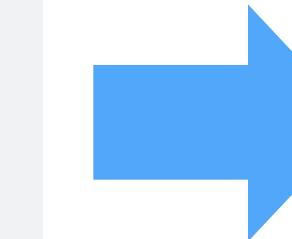
# Markdown

A simple way to write HTML.  
Mostly plain english (like an email)

```
# Say Hello  
To my little  
friend, markdown.
```

Markdown is

- \* easy to use
- \* simple
- \* fun?



## Say Hello

To my little friend, markdown.  
Markdown is

- easy to use
- simple
- fun?

## Web sites that use markdown

- \* **GitHub** [www.github.com](http://www.github.com)
- \* **StackOverflow** [www.stackoverflow.com](http://www.stackoverflow.com)
- \* **Reddit** [www.reddit.com](http://www.reddit.com)
- \* **Meteor** [www.meteor.com](http://www.meteor.com)
- \* many more



# Markdown Quick Reference

The screenshot shows the RStudio interface with the Help menu open. The 'Markdown Quick Reference' option is highlighted and circled in blue. The main pane displays an R Markdown document titled 'Untitled'. The document content includes code chunks and explanatory text about R Markdown. The right pane shows the 'Markdown Quick Reference' help page, which provides a summary of the format and examples for various Markdown elements like emphasis and headers.

1 ---  
2 **title:** "Untitled"  
3 **author:** "RStudio"  
4 **date:** "October 12, 2015"  
5 **output:** html\_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts\_chunk\$set(echo = TRUE)  
10```  
11  
12 **## R Markdown**  
13  
14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <<http://rmarkdown.rstudio.com>>.  
15  
16 When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:  
17

2:1 Untitled ▾ R Markdown ▾

Console ~ /Dropbox (RStudio)/RStudio/training/G-Shiny-Ambassador-Webinars/ >

Help

- R Help
- About RStudio
- Check for Updates
- RStudio Docs
- RStudio Support
- Markdown Quick Reference**
- Roxygen Quick Reference**
- Cheatsheets
- Diagnostics

G-Shiny-Ambassador-Webinars

Search

Environment is empty

Files Plots Packages Help Viewer

Markdown Quick Reference Find in Topic

## Markdown Quick Reference

R Markdown is an easy-to-write plain text format for creating dynamic documents and reports. See [Using R Markdown](#) to learn more.

### Emphasis

\*italic\* \*\*bold\*\*  
\_italic\_ \_\_bold\_\_

### Headers

# Header 1  
## Header 2  
### Header 3

### Lists

Unordered List

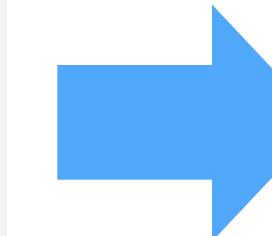
\* Item 1

# Headers

Use # to create headers.

Multiple #'s create lower level headers.

```
# Header 1  
## Header 2  
### Header 3  
#### Header 4  
##### Header 5  
##### Header 6
```



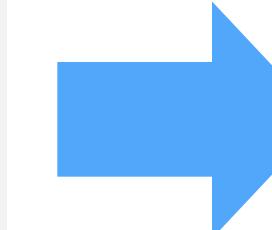
**Header 1**  
**Header 2**  
**Header 3**  
**Header 4**  
**Header 5**  
**Header 6**

# Text

Add two spaces at  
the end of a line to  
start a new line

Text is rendered as plain text. Use underscores (\_) to make italics, two underscores (\_\_) to make bold, back ticks to make code.

Text  
italics  
bold  
`code`



**Text**  
*italics*  
**bold**  
**code**

# Lists

Use asterisks to make bullet points.  
Use numbers to make numbered lists.

## Bullets

- \* bullet 1
- \* bullet 2

## Numbered list

1. item 1
2. item 2



## Bullets

- bullet 1
- bullet 2

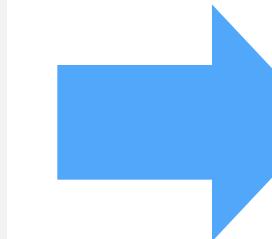
## Numbered list

1. item 1
2. item 2

# Hyperlinks

Use brackets to denote a link. Place the URL in parentheses.

This is a  
[link]([www.git.com](http://www.git.com)).

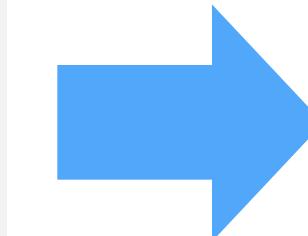


**This is a link.**

# Equations

Write equations with latex math commands and surround them in \$'s.

According to Einstein,  
 $E=mc^2$



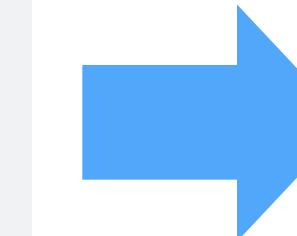
According to Einstein,  $E = mc^2$

# Equation blocks

Use two \$'s to make centered equation blocks.

According to Einstein,

$\$\$E=mc^{\{2\}}\$\$$



According to Einstein,

$E = mc^2$

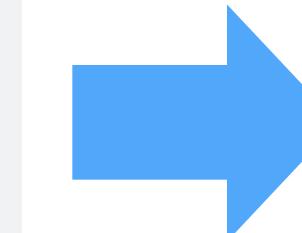
# Images

Use a link preceded by an ! to insert an image.

*The link text should be*

- *a URL (if the image is hosted online)*
- *a file path (if the image is saved as a file)*

``  
The RStudio logo.



*Note: You must save your .Rmd file before the preview will find the image*

# R Markdown Reference Guide

[www.rstudio.com/resources/cheatsheets/](http://www.rstudio.com/resources/cheatsheets/)

 **R Markdown** Reference Guide

Learn more about R Markdown at [rmarkdown.rstudio.com](http://rmarkdown.rstudio.com)  
Learn more about Interactive Docs at [shiny.rstudio.com/articles](http://shiny.rstudio.com/articles)

**Contents:**

- 1. Markdown Syntax**
- 2. Knitr chunk options
- 3. Pandoc options

Syntax	Becomes
Plain text	Plain text
End a line with two spaces to start a new paragraph.	End a line with two spaces to start a new paragraph.
*italics* and _italics_	<i>italics</i> and <i>italics</i>
**bold** and __bold__	<b>bold</b> and <b>bold</b>
superscript <sup>2</sup>	superscript <sup>2</sup>
~~strikethrough~~	strikethrough
[link](www.rstudio.com)	<a href="#">link</a>
# Header 1	<b>Header 1</b>
## Header 2	<b>Header 2</b>
### Header 3	<b>Header 3</b>
#### Header 4	<b>Header 4</b>
##### Header 5	<b>Header 5</b>
##### Header 6	<b>Header 6</b>
endash: --	endash: –
emdash: ---	emdash: —
ellipsis: ...	ellipsis: ...
inline equation: \$A = \pi * r^2\$	inline equation: $A = \pi * r^2$
image:	image: 
horizontal rule (or slide break):	horizontal rule (or slide break):
***	

# knitr

# code chunks

# Embed code

Insert a chunk of R code with

```
```{r}  
# some code
```

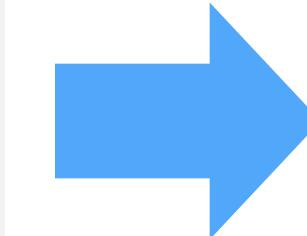
```
```
```

When you compile, R markdown will run the code and include its results. R markdown will also remove the ```{r} and ```.

# inline code

Place code in a sentence with `r #code`. R Markdown will replace the code with its results.

Today is  
`r Sys.Date()`.



Today is 2015-04-16.

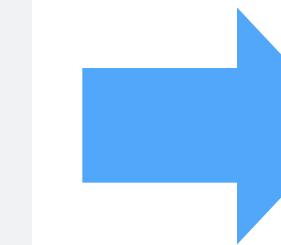
You cannot add options  
to inline code

# chunk options

By default, R markdown includes both the code and its results

Here's some code

```
```{r}  
dim(iris)  
```
```



Here's some code

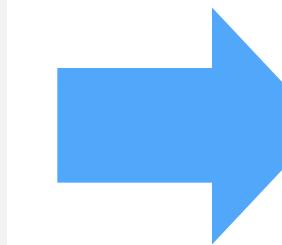
```
dim(iris)
```

```
## [1] 150 5
```

# echo

Add options in the brackets after r.  
**echo = FALSE** hides the code.

```
Here's some code  
```{r echo=FALSE}  
dim(iris)  
```
```

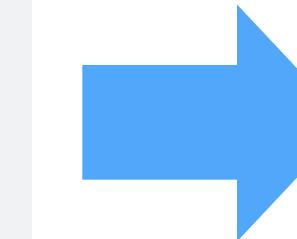


```
Here's some code  
## [1] 150 5
```

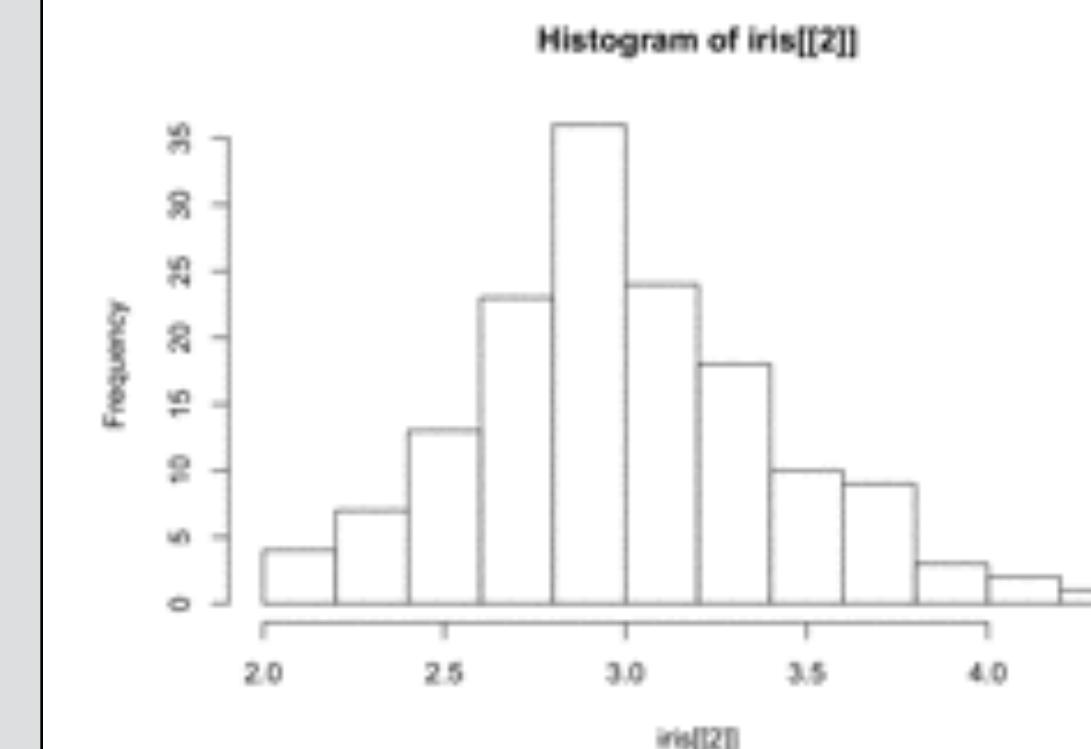
# echo

Add options in the brackets after r.  
**echo = FALSE** hides the code.

```
Here's a plot  
```{r echo=FALSE}  
hist(iris[[2]])  
```
```



Here's a plot

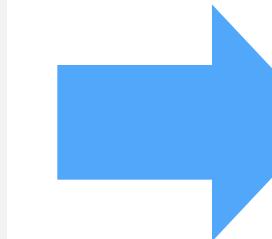


This is very useful  
for plots

# eval

**eval = FALSE** prevents the code from being run.  
As a result, no results will be displayed with the code

```
Here's some code  
```{r eval=FALSE}  
dim(iris)  
```
```



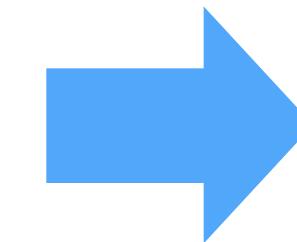
```
Here's some code  
dim(iris)
```

# fig.height, fig.width

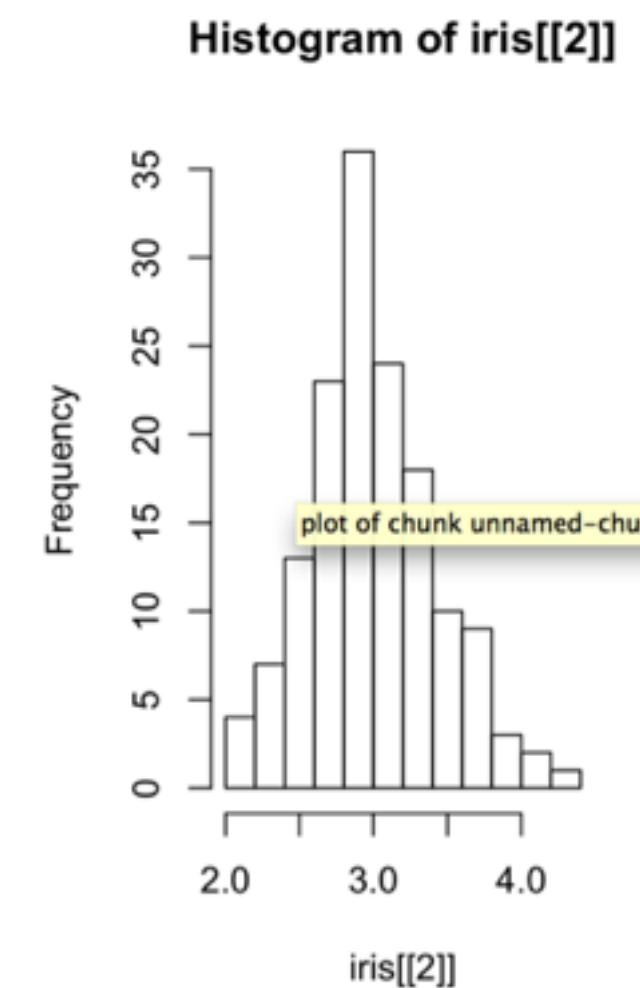
Specify the dimension of plots (in inches) with `fig.width` and `fig.height`. Separate multiple arguments with commas.

Here's a plot

```
```{r echo=FALSE, fig.width=3, fig.height=5}  
hist(iris[[2]])  
```
```



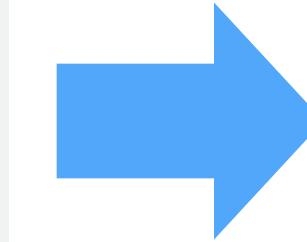
Here's a plot



# message

**message = FALSE** suppresses messages from appearing in the output.

```
Here's some code  
```{r message=FALSE}  
library(forecast)  
```
```



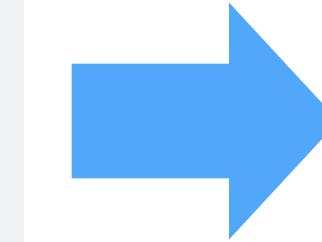
```
Here's some code  
library(forecast)
```

# warning

**warning = FALSE** suppresses warnings from appearing in the output.

```
Here's some code  
```{r warning=FALSE}  
warning("Don't!")  
```
```

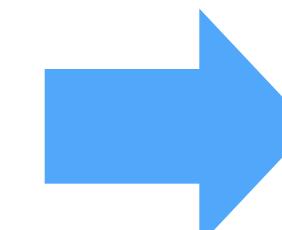
```
Here's some code  
warning("Don't!")
```



# engine

To embed non R code, set the engine option to the language you want to embed.

```
Some python code,  
```{r engine='python'}  
x = 'hello, python  
world!'  
print(x)  
print(x.split(' '))  
```
```



Some python code:

```
x = 'hello, python world!'  
print(x)  
print(x.split(' '))
```

```
## hello, python world!  
## ['hello,', 'python', 'world!']
```

knitr comes with engines for the following languages, and can be extended to other languages

|             |             |               |      |
|-------------|-------------|---------------|------|
| asis        | coffee      | <b>python</b> | sed  |
| asy         | dot         | Rcpp          | sh   |
| awk         | gawk        | Rscript       | tikz |
| <b>bash</b> | haskell     | <b>ruby</b>   | zsh  |
| <b>c</b>    | highlight   | <b>sas</b>    |      |
| cat         | <b>perl</b> | scala         |      |

# Logistics

1

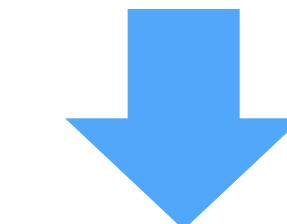
Knitr runs the document in a fresh R session,  
which means you need to load the libraries  
that the document uses *in the document*

# Logistics

1

Knitr runs the document in a fresh R session,  
which means you need to load the libraries  
that the document uses *in the document*

```
```{r}
qplot(temperature, pressure, data = pressure)
```
```



Error : could not find function "qplot"

# Logistics

1

Knitr runs the document in a fresh R session,  
which means you need to load the libraries  
that the document uses *in the document*

2

Objects made in one code chunk will be  
available to code in later code chunks.

# R Markdown Reference Guide

[www.rstudio.com/resources/cheatsheets/](http://www.rstudio.com/resources/cheatsheets/)

The screenshot shows the R Markdown Reference Guide page. At the top left is the R Studio logo. To its right is the title "R Markdown Reference Guide". Below the title are two links: "Learn more about R Markdown at [rmarkdown.rstudio.com](#)" and "Learn more about Interactive Docs at [shiny.rstudio.com/articles](#)". To the right of these links is a "Contents" sidebar with three items: "1. Markdown Syntax", "2. Knitr chunk options", and "3. Pandoc options". The main content area is divided into two columns: "Syntax" and "Becomes". Under "Syntax", there are examples for code chunks with three back ticks, inline code with single back ticks, and chunk options within braces. Each example has a corresponding "Becomes" section showing the resulting R code and output. At the bottom of the page is a "Chunk options" table.

**R Markdown** Reference Guide

Learn more about R Markdown at [rmarkdown.rstudio.com](#)  
Learn more about Interactive Docs at [shiny.rstudio.com/articles](#)

Contents:

- 1. Markdown Syntax
- 2. Knitr chunk options**
- 3. Pandoc options

| Syntax  | Becomes   |
|---|---|
| Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:<br><pre>```{r} paste("Hello", "World!") ```</pre>                        | Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:<br><pre>paste("Hello", "World!")</pre><br><pre>## [1] "Hello World!"</pre> |
| Place code inline with a single back ticks. The first back tick must be followed by an R, like this `r paste("Hello", "World!")`.   | Place code inline with a single back ticks. The first back tick must be followed by an R, like this Hello World!.   |
| Add chunk options within braces. For example, 'echo=FALSE' will prevent source code from being displayed:<br><pre>```{r eval=TRUE, echo=FALSE} paste("Hello", "World!") ```</pre> | Add chunk options within braces. For example, <code>echo=FALSE</code> will prevent source code from being displayed:<br><pre>## [1] "Hello World!"</pre>                            |

Learn more about chunk options at <http://yihui.name/knitr/options>

| Chunk options          |               |   |
|------------------------|---------------|---|
| option                 | default value | description   |
| <b>Code evaluation</b> |               |   |
| <code>child</code>     | NULL          | A character vector of filenames. Knitr will knit the files and place them into the main document.   |
| <code>code</code>      | NULL          | Set to R code. Knitr will replace the code in the chunk with the code in the code option.   |
| <code>engine</code>    | 'R'           | Knitr will evaluate the chunk in the named language, e.g. <code>engine = 'python'</code> . Run <code>names(knitr::knit_engines\$get())</code> to see supported languages. |
| <code>eval</code>      | TRUE          | If FALSE, knitr will not run the code in the code chunk.  |
| <code>include</code>   | TRUE          | If FALSE, knitr will run the chunk but not include the chunk in the final document.   |
| <code>purl</code>      | TRUE          | If FALSE, knitr will not include the chunk when running <code>purl()</code> to extract the source code.   |
| <b>Results</b>         |               |   |
| <code>collapse</code>  | FALSE         | If TRUE, knitr will collapse all the source and output blocks created by the chunk into a single block.   |
| <code>echo</code>      | TRUE          | If FALSE, knitr will not display the code in the code chunk above it's results in the final document.   |
|                        |               | If 'hide', knitr will not display the code's results in the final document. If 'hold', knitr will delay displaying all output   |

# output formats

# Untitled

RStudio  
April 16, 2015

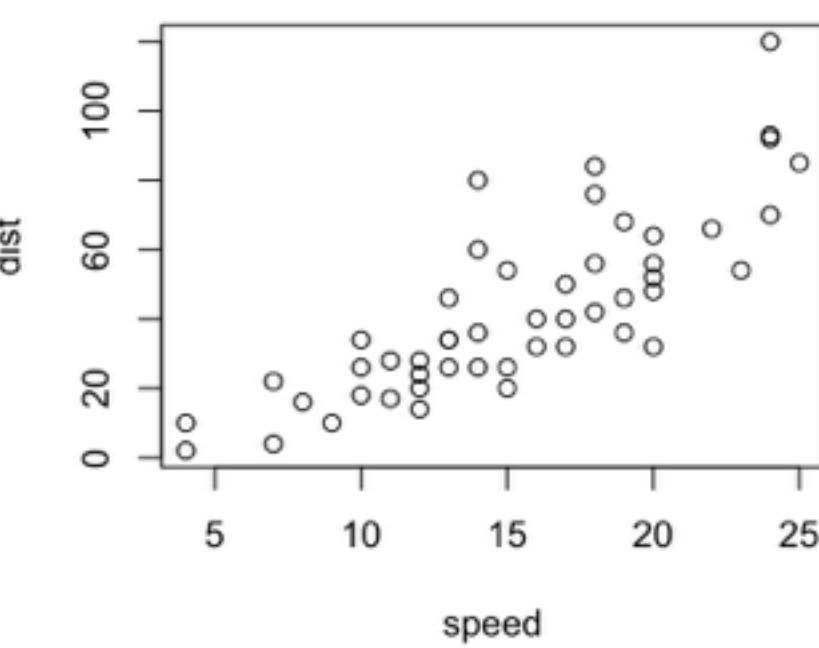
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed      dist
## Min.   : 4.0   Min.   : 2.00
## 1st Qu.:12.0  1st Qu.: 26.00
## Median :15.0  Median : 36.00
## Mean   :15.4  Mean   : 42.98
## 3rd Qu.:19.0  3rd Qu.: 56.00
## Max.   :25.0   Max.   :120.00
```

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

# HTML

# PDF

\* preview requires *tex*

# Untitled

RStudio  
April 16, 2015

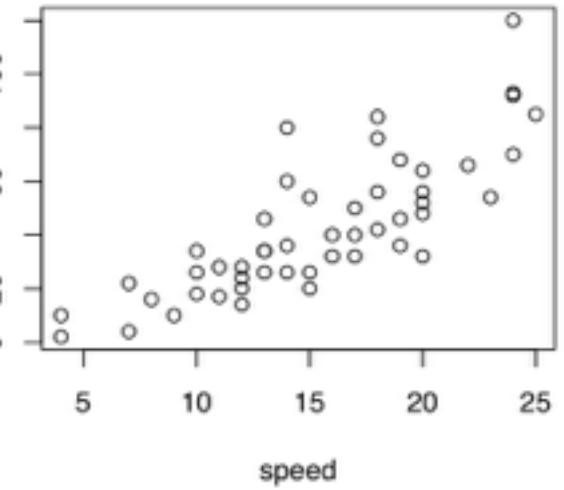
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

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## Max.   :25.0   Max.   :120.00
```

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

# MS Word

\* preview requires "Word"

# Untitled

RStudio  
April 16, 2015

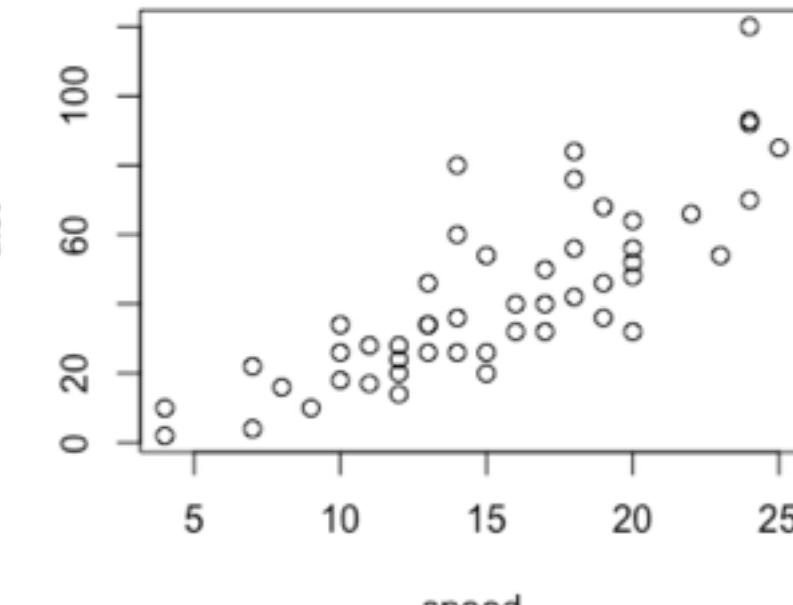
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

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## 1st Qu.:12.0  1st Qu.: 26.00
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## Mean   :15.4  Mean   : 42.98
## 3rd Qu.:19.0  3rd Qu.: 56.00
## Max.   :25.0   Max.   :120.00
```

You can also embed plots, for example:

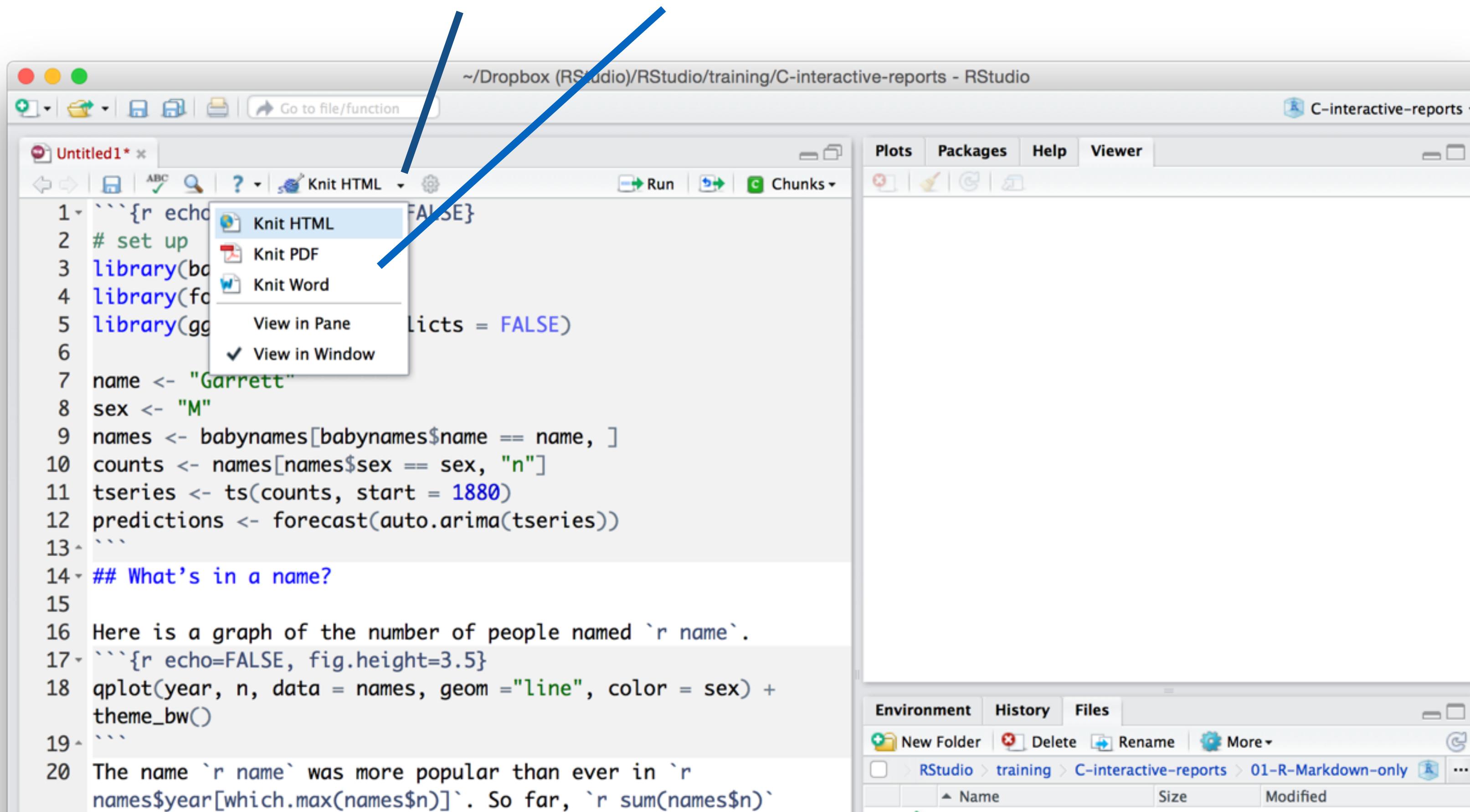


Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

# Output

1. Open drop down menu

2. Select format



# YAML

A section of key:value pairs separated by  
dashed lines — — —

```
---  
title: "Untitled"  
author: "RStudio"  
date: "February 4, 2015"  
output: html_document
```

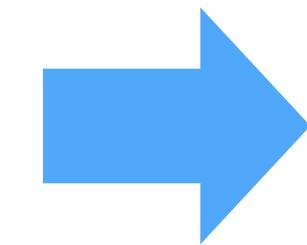
```
---
```

Text of document

# YAML

A section of key:value pairs separated by dashed lines — — —

**Most important  
option**



```
---  
title: "Untitled"  
author: "RStudio"  
date: "February 4, 2015"  
output: html_document  
---  
Text of document
```

# output templates

|                       |   |
|-----------------------|---|
| html_document         | HTML document                                 |
| pdf_document          | pdf document                                  |
| word_document         | Microsoft .docx file                          |
| md_document           | markdown file (converts R output to markdown) |
| ioslides_presentation | ioslides HTML 5 slideshow                     |
| slidy_presentation    | slide HTML 5 slideshow                        |
| beamer_presentation   | beamer pdf slideshow                          |

# Slide divisions

R Markdown will start a new slide at each first  
(and second\*) level header, and horizontal rule

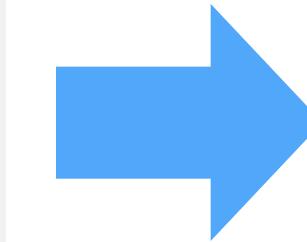
\* *ioslides only*

```
# Slide 1  
text
```

```
## Slide 2  
text
```

\*\*\*

Slide 3



# Slide bullets

Start bullets with -

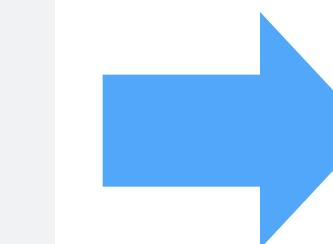
Incremental bullets with >-

```
## Slide 1
```

- Bullet 1
- Bullet 2

```
## Slide 2
```

- >- Bullet A
- >- Bullet B



Slide 1

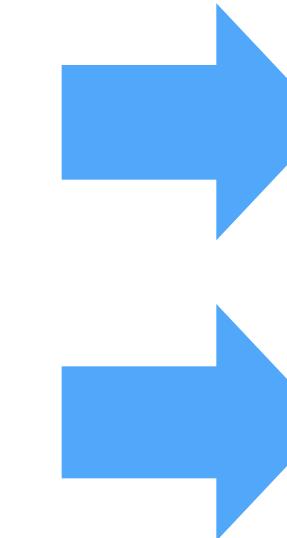
- Bullet 1
- Bullet 2

Slide 2

# Parameters

A list of values that you can call in R code chunks

**params list**  
**elements and  
values**



```
---
```

```
title: "Untitled"
output: html_document
params:
  filename: "data.csv"
  symbol: "GOOG"
---
```

Access as **params\$filename** and **params\$symbol**

# rmarkdown::render

Render at the command line with YAML options

```
> render("doc.Rmd")
```

Render at the command line, set parameters.

```
> render("doc.Rmd", params = list(  
  filename = "other_data.csv",  
  symbol = "AAPL")
```

# rmarkdown::render

Render at the command line with YAML options

```
> render("doc.Rmd")
```

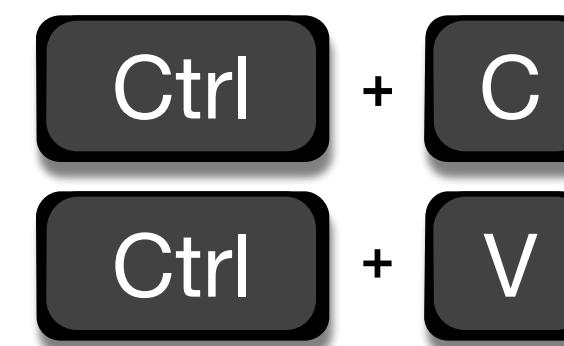
Render at the command line, override output format.

```
> render("doc.Rmd", "html_document")
```

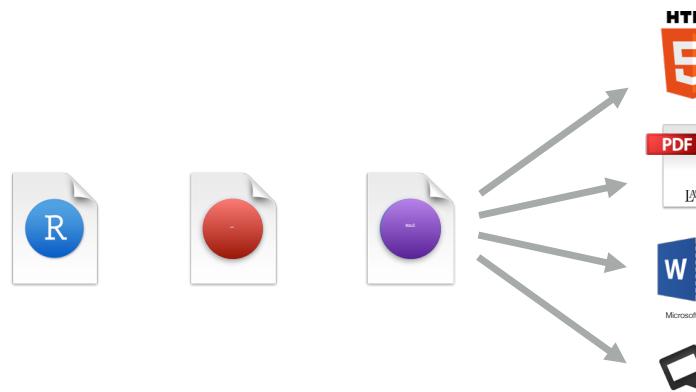
Render at the command line to multiple formats.

```
> render("doc.Rmd", c("html_document", "pdf_document"))
```

# Recap: R Markdown



Reproducible



Automatic



Flexible

**params:**

Reusable

Parameterizable

**Teach yourself  
R Markdown**

# The R Markdown Reference Guide

[www.rstudio.com/resources/cheatsheets/](http://www.rstudio.com/resources/cheatsheets/)

The screenshot shows the R Markdown Reference Guide page. At the top left is the R Studio logo. To its right is the title "R Markdown Reference Guide". Below the title are two links: "Learn more about R Markdown at [rmarkdown.rstudio.com](#)" and "Learn more about Interactive Docs at [shiny.rstudio.com/articles](#)". To the right of these links is a "Contents" sidebar with three items: "1. Markdown Syntax", "2. Knitr chunk options", and "3. Pandoc options". The main content area has a header "Syntax" and "Becomes". Under "Syntax", there are two examples: one for inline code and one for code chunks with options. Each example includes R code and its resulting output. Below this is a section titled "Chunk options" with a table showing various options and their descriptions.

**R Markdown** Reference Guide

Learn more about R Markdown at [rmarkdown.rstudio.com](#)  
Learn more about Interactive Docs at [shiny.rstudio.com/articles](#)

Contents:

- 1. Markdown Syntax
- 2. Knitr chunk options**
- 3. Pandoc options

| Syntax  | Becomes   |
|---|---|
| Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:<br><pre>```{r}<br/>paste("Hello", "World!")<br/>```</pre>                        | Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:<br><pre>paste("Hello", "World!")</pre><br><pre>## [1] "Hello World!"</pre> |
| Place code inline with a single back ticks. The first back tick must be followed by an R, like this `r paste("Hello", "World!")`.   | Place code inline with a single back ticks. The first back tick must be followed by an R, like this Hello World!.   |
| Add chunk options within braces. For example, `echo=FALSE` will prevent source code from being displayed:<br><pre>```{r eval=TRUE, echo=FALSE}<br/>paste("Hello", "World!")<br/>```</pre> | Add chunk options within braces. For example, <code>echo=FALSE</code> will prevent source code from being displayed:<br><pre>## [1] "Hello World!"</pre>                            |

Learn more about chunk options at <http://yihui.name/knitr/options>

| Chunk options          |               |   |
|------------------------|---------------|---|
| option                 | default value | description   |
| <b>Code evaluation</b> |               |   |
| <code>child</code>     | NULL          | A character vector of filenames. Knitr will knit the files and place them into the main document.   |
| <code>code</code>      | NULL          | Set to R code. Knitr will replace the code in the chunk with the code in the code option.   |
| <code>engine</code>    | 'R'           | Knitr will evaluate the chunk in the named language, e.g. <code>engine = 'python'</code> . Run <code>names(knitr::knit_engines\$get())</code> to see supported languages. |
| <code>eval</code>      | TRUE          | If FALSE, knitr will not run the code in the code chunk.  |
| <code>include</code>   | TRUE          | If FALSE, knitr will run the chunk but not include the chunk in the final document.   |
| <code>purl</code>      | TRUE          | If FALSE, knitr will not include the chunk when running <code>purl()</code> to extract the source code.   |
| <b>Results</b>         |               |   |
| <code>collapse</code>  | FALSE         | If TRUE, knitr will collapse all the source and output blocks created by the chunk into a single block.   |
| <code>echo</code>      | TRUE          | If FALSE, knitr will not display the code in the code chunk above it's results in the final document.   |
|                        |               | If 'hide' knitr will not display the code's results in the final document. If 'hold', knitr will delay displaying all output  |

# The R Markdown Cheat Sheet

[www.rstudio.com/resources/cheatsheets/](http://www.rstudio.com/resources/cheatsheets/)

**R Markdown** Cheat Sheet  
learn more at [rmarkdown.rstudio.com](http://rmarkdown.rstudio.com)

rmarkdown 0.2.50 Updated: 8/14



**2. Open File** Start by saving a text file with the extension .Rmd, or open an RStudio Rmd template

- In the menu bar, click **File > New File > R Markdown...**
- A window will open. Select the class of output you would like to make with your .Rmd file
- Select the specific type of output to make with the radio buttons (you can change this later)
- Click OK

**4. Choose Output** Write a YAML header that explains what type of document to build from your R Markdown file.

**YAML**  
A YAML header is a set of key: value pairs at the start of your file. Begin and end the header with a line of three dashes (---)

```
title: "Untitled"
author: "Anonymous"
output: html_document
---
```

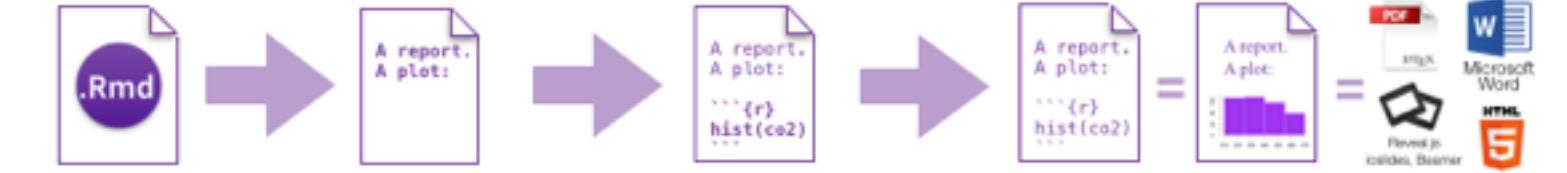
The output value determines which type of file R will build from your .Rmd file (in Step 6)

|                                      |       |                           |
|--------------------------------------|-------|---------------------------|
| <b>output: html_document</b>         | ..... | html file (web page)      |
| <b>output: pdf_document</b>          | ..... | pdf document              |
| <b>output: word_document</b>         | ..... | Microsoft Word .docx      |
| <b>output: beamer_presentation</b>   | ..... | beamer slideshow (pdf)    |
| <b>output: ioslides_presentation</b> | ..... | ioslides slideshow (html) |

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**1. Workflow** R Markdown is a format for writing reproducible, dynamic reports with R. Use it to embed R code and results into slideshows, pdfs, html documents, Word files and more. To make a report:

- Open** - Open a file that uses the .Rmd extension.
- Write** - Write content with the easy to use R Markdown syntax
- Embed** - Embed R code that creates output to include in the report
- Render** - Replace R code with its output and transform the report into a slideshow, pdf, html or ms Word file.



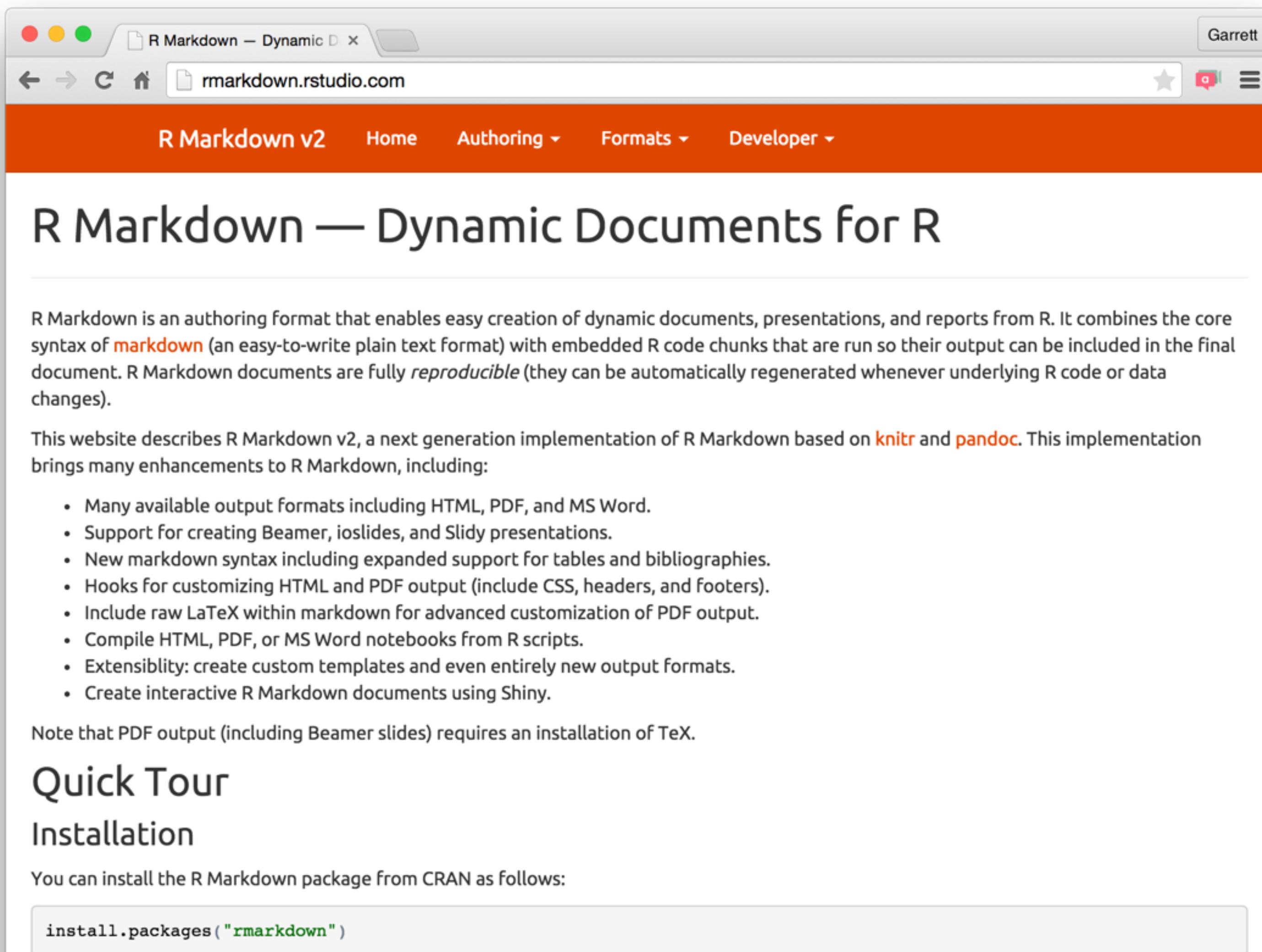
**2. Open File** Start by saving a text file with the extension .Rmd, or open an RStudio Rmd template

**3. Markdown** Next, write your report in plain text. Use markdown syntax to describe how to format text in the final report.

| syntax                            | becomes  |
|-----------------------------------|--|
| Plain text                        | Plain text<br>End a line with two spaces to start a new paragraph.<br><i>italics*</i> and <u>underlines</u><br><b>bold**</b> and <u><b>bold</b></u><br><u>superscript</u> <sup>2</sup><br><del>strikethrough</del> |
| # Header 1                        | <b>Header 1</b>  |
| ## Header 2                       | <b>Header 2</b>  |
| ### Header 3                      | <b>Header 3</b>  |
| #### Header 4                     | <b>Header 4</b>  |
| ##### Header 5                    | <b>Header 5</b>  |
| ###### Header 6                   | <b>Header 6</b>  |
| endash: --                        | endash: –  |
| emdash: ---                       | emdash: ––   |
| ellipsis: ...                     | ellipsis: ...  |
| inline equation: \$A = \pi r^2\$  | inline equation: $A = \pi r^2$   |
| image:   |   |
| horizontal rule (or slide break): | horizontal rule (or slide break):  |
| ***                               |  |
| > block quote                     | block quote  |
| * unordered list                  | * unordered list   |
| * item 2                          | * item 2   |
| + sub-item 1                      | + sub-item 1   |
| + sub-item 2                      | + sub-item 2   |
| 1. ordered list                   | 1. ordered list  |
| 2. item 2                         | 2. item 2  |
| + sub-item 1                      | + sub-item 1   |
| + sub-item 2                      | + sub-item 2   |
| Table Header   Second Header      | Table Header      Second Header  |
| -----                             | -----  |
| Table Cell   Cell 2               | Table Cell      Cell 2   |
| Cell 3   Cell 4                   | Cell 3      Cell 4   |

# The R Markdown Development Center

[rmarkdown.rstudio.com](http://rmarkdown.rstudio.com)

A screenshot of a web browser displaying the R Markdown website. The title bar shows the window is titled "R Markdown – Dynamic" and the address bar shows the URL "rmarkdown.rstudio.com". The page itself has a white background with an orange header bar containing navigation links for "R Markdown v2", "Home", "Authoring", "Formats", and "Developer". The main content area features a large heading "R Markdown — Dynamic Documents for R". Below this, there is a paragraph of text explaining what R Markdown is, followed by another paragraph about the R Markdown v2 implementation. A bulleted list details the features of R Markdown v2. At the bottom, there is a note about TeX requirements and two sections: "Quick Tour" and "Installation".

R Markdown is an authoring format that enables easy creation of dynamic documents, presentations, and reports from R. It combines the core syntax of [markdown](#) (an easy-to-write plain text format) with embedded R code chunks that are run so their output can be included in the final document. R Markdown documents are fully *reproducible* (they can be automatically regenerated whenever underlying R code or data changes).

This website describes R Markdown v2, a next generation implementation of R Markdown based on [knitr](#) and [pandoc](#). This implementation brings many enhancements to R Markdown, including:

- Many available output formats including HTML, PDF, and MS Word.
- Support for creating Beamer, ioslides, and Slidy presentations.
- New markdown syntax including expanded support for tables and bibliographies.
- Hooks for customizing HTML and PDF output (include CSS, headers, and footers).
- Include raw LaTeX within markdown for advanced customization of PDF output.
- Compile HTML, PDF, or MS Word notebooks from R scripts.
- Extensibility: create custom templates and even entirely new output formats.
- Create interactive R Markdown documents using Shiny.

Note that PDF output (including Beamer slides) requires an installation of TeX.

## Quick Tour

## Installation

You can install the R Markdown package from CRAN as follows:

```
install.packages("rmarkdown")
```